The Present Status of Abdominal Fascial Transplants

C. L. LOWMAN, M.D., *Los Angeles*

SUMMARY

In recent years improvements have been made in techniques for transplanting fascia into the muscles of the abdomen to take over the function of paralyzed muscles. The techniques are described in this presentation.

Since muscular coordination of pelvis and thorax plays an important part in control of the extremities, better methods of placing transplants across the abdomen to link these regions offer, coincidentally, the benefit of better use of muscles in the arms and legs.

If done early and skillfully, abdominal fascial transplants and allied transplants not only aid in restoring function but often prevent deformities.

THE technique of abdominal fascial transplants has evolved and the field of application has broadened since 1932 when the author reported* on the first eleven cases in which he had performed the operation to strengthen the abdominal wall of patients with paralysis of muscles in that area as a result of poliomyelitis.

To understand present procedure, it should be remembered that the base of muscle action must be maintained in a fixed position to obtain effective motion. To get such stabilization of the base, a flow of action from one muscle group to another is needed until the base is reached.

For example, when a leg is raised, the weight of the leg is transmitted to the pelvis, thence via abdominal and lateral loin musculature to the thorax and spine. If one link in this chain is broken, as when all or part of the abdominal muscles are paralyzed, the pelvis will tip downward and/or sideward.

The presence of Beevor's sign (movement of the umbilicus towards the active portion of the abdominal wall) is indication for the operation. In a normal abdominal wall, or in a completely paralyzed wall, this sign is absent. It exists only when parts of the muscles are affected.

The operation itself consists of placing sections of fascia in positions to act as tendons to transmit the force to the pelvis or rib cage from the acting section of the abdominal wall.

If the lower half of the abdomen is paralyzed (both lower obliques and lower rectus) the umbilicus will move upward during any movement of legs or upper trunk. Correction calls for three straps, two from just above the umbilicus to the anterior ends of the iliac crests, and another strap directly downward to the symphysis pubis.

If the upper half of the abdomen is paralyzed, correction requires two straps from the active lower recti just below each side of the umbilicus, running up to costal margin and attached 2 or 3 inches outward from the midline. The distance varies with the size of the patient. Thus, force from both lower obliques and lower recti will be split and effectively anchored. The direction of the arms of this "Y" may be altered in accordance with the degree and position of the weakness. For example, if an upper right oblique has some strength but the left has none, and the upper rectus none, the right arm of the "Y" should be placed nearer to the midline, and the left arm farther outward.

If the upper and lower obliques on the same side are both paralyzed, with a good quadratus lumborum on that side and a good rectus in front, two straps are needed—one from the umbilicus to the crest above the anterior superior spine, the other upward to the rib cage on the same side. These should go above the floating ribs. If the costal margin is thick it may be split and the fascial strip passed through the slot and turned back upon itself, or, if this is more convenient, it may be passed around a rib subperiosteally. In the latter case, care should be used to avoid damaging intercostal vessels.

If the lateral loin muscles of the paralyzed side are also paralyzed, three straps are used—two as noted in the preceding paragraph, with a third placed laterally in the mid-axillary line from the crest to the tenth rib and fastened around the rib. The iliac incision should be about 3 inches long; the lower oblique strap is inserted through a hole in the ilium at the front end of the incision, and the lateral strap at its other end. Straps should be fastened in the umbilical area first.

While one surgeon makes beds for the implants in the various incisions in costal, iliac, and umbilical areas, assistant surgeons take a fascial strip from the opposite leg. The full-width strip is then placed on a board, spread out, and all fatty substance scraped from its ends for about 1 to 1½ inches. It is split longitudinally to make two or three strips. Next, the tunneler is passed through from one incision to the others and clamped lightly to a strip, which is then pulled through the tunnel. An assistant grasps the heavy tissue at the central incision with a Kocher clamp and holds it taut to resist the thrust of the tunneler (usually a uterine packer) as it passes through the subcutaneous fat layer. If the abdomen is thin-walled, care must be taken not to puncture the skin.

A flap of rectus aponeurosis (previously made by inch-apart parallel incisions) is then picked up and the end of the fascial strap spread out under it and stitched to the muscle with four silk stitches. The same procedure is then done with the other strip, and the aponeurotic flap fastened with No. 0 chromatic suture.

At this stage the operating table is broken in the

*In a paper read at a meeting of the American Orthopedic Society in Toronto.

middle to slacken the abdominal wall tension. The assistant grasps the stem of the navel and slowly, steadily pulls against the healthy section of the muscle while the surgeon and another assistant pass the lower end through the ilium or ribs (as the case may be). After the lower end is passed through, the end is clamped and held at the required tension while the surgeon passes a suture through the periosteum and fascial strip. The end is then passed back over the ilium or ribs and stitched to itself with silk. When the second insertion is made, care should be taken to take up all slack and prevent alteration of tension of the first strap.

If a lateral strap also is passed, the table is somewhat flattened (not made completely flat) and the last strip is run from the tenth rib to the ilium. The body is swung over, or the legs or brought around to slacken the side. For patients with flat backs or little lordosis, the table is broken very little. If there is much lordosis and a quite flat abdomen, considerable flexion is given.

The surgeon must take various factors into consideration in deciding the amount of tension to be placed on the straps. The degree of shortening in the active sections of the muscle, as well as contractility and strength, affects the possibility of elongation. The stretching of the points of attachment, the curvature of the abdomen, the amount and character of the fat, and the degree of elasticity in the active section all must be considered in the final adjustment of tension.

Sutures should be removed in 12 to 14 days and free floating exercise in a therapeutic pool should be started in the third week. The patient should walk in deep water at the end of the third week and in shallow water in the fourth week. After that, wearing a corset or girdle, the patient should walk with crutches. If extensive involvement of the leg is present and double full-length leg braces are used, a shoulder harness permits the weight of the braces to be carried from the shoulders so that little load is put upon the new transplants. After six or seven weeks this harness can be loosened gradually or left unconnected for brief periods before it is left off entirely. Fascial abdominal transplants should be done as early as a clear pattern of imbalance can be determined and before contracture and shortening of the overacting sections of the muscles take place. If the whole abdominal wall is paralyzed, three or four months after the acute attack is not too early for the operation. Continued training of the muscles of the extremities will activate the trunk stabilizers (notably the abdominals). If strength is present in some sections of the abdominal muscles and absent in others, imbalance will be increased. Improvement of performance cannot be obtained as long as the abdominal fixators are out of action or are seriously unbalanced. The original technique of the operation in which the sheath of the rectus was opened from umbilicus to symphysis, the aponeurosis lifted and the fascial strap placed flat on the muscle, has now been modified so that this strap is attached as indicated in preceding paragraphs. Tunneling is made down to the lower incision over the symphysis where it is fastened through a subperiosteal opening in the symphysis (as previously described for the iliac attachment).

In cases in which all abdominal muscles are paralyzed, criss-cross straps are run anteriorly from the crest of one ilium up to the opposite costal border via the central incision. This is the first stage of the operation. At a second stage, about eight weeks later, two lateral straps are put from mid-ilium to the tenth rib. If the back of the patient is fairly flat, these straps are placed a little in front of the mid-axillary line; in case of lordosis they are put still farther forward.

Occasionally if the patient has a short thigh it is hard to get a strip that is long enough to reach diagonally across a long abdomen. In this event two spliced strips will work satisfactorily. In one such case, one long strip was run down from one rib incision to the middle incision, thence up to the opposite rib incision. Two shorter pieces then were attached at the ilia and passed upward and fastened around the loop made by the first strip. The crossed straps should be left free to glide over each other. Otherwise the rotatory force of the trunk will not be transmitted to the opposite side of the pelvis.

Another procedure has been evolved to give some use of the legs to patients who are unable to walk because of paralysis of the flexor muscles of the hips. One strip is run down from a good rectus abdominis into the leg, where it is fastened to the ends of the detached sartorius and a strip from the front portion of the tensor fascia femoris at a point 2 inches below Poupart's ligament.

The author uses a similar fascial extension to correct gluteus medius limp.[1] A fascial strip 1½ inches wide is left attached at the trochanter, fixed to its deep fascia with silk. The free end of the strip is passed upward through the fat to an upper incision in which a section of the external abdominal oblique has been lifted and detached from the crest. After the gap in muscle and fascia under this projecting piece of muscle is closed, the leg is abducted and the end of the fascial strip passed into the muscle tab. While on reasonable tension the strip is fixed in place with several silk sutures. The lower end is tapered down to a point by carrying the muscle strands around the strip. This serves to transmit some of the fixator action directly to the trochanter, helps the weak medius, and acts to stabilize the pelvis laterally. No postoperative splints are needed. The patient lies on a flattened bed and the leg is held in a 45-degree abduction. It is tied in this position with a broad bandage run from a point above the knee to an anchorage on the side of the bed. A countering bandage is placed around the pelvis and fixed to the opposite side of the bed, and a third band is placed around the chest and anchored to keep the patient from slewing to a diagonal position on the bed.

2417 South Hope Street.

1. Lowman, C. L.: Lateral fascial transplants for controlling gluteus medius limp, Physiotherapy Rev., 27:355-357 (Nov.-Dec.), 1947.